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DOES HAVING A TECHNICAL DEGREE MAKE A BETTER SPACE OR MISSILE OPERATOR?

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A Research Report Submitted to the Faculty In Partial Fulfillment of the Graduation Requirements

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We are a nation at war. Warring nations can ill afford to waste money on desired, yet unnecessary expenditures. This happens all across the Air Force every time a 2nd Lieutenant enters active duty with a technical degree, yet goes into a job that does not require the high level of technical competence possessed by the Lieutenant. This paper shows, using statistical analysis and case studies, that an expensive degree is not required for a 13S space operator, and therefore there is no need for the Air Force to foot the bill if the skill set is not going to be used. Space and missile operations is a career field that has a force where almost 30% possess technical degrees; in fact over 50% of 2009s Air Force Academy graduating class categorized as a 13S has a technical degree, yet this paper will show that no such degree is required. This is too much. The attitude of, train everyone to the same high standard, and they can succeed in any job, is not without merit; engineers and those with technical degrees can and do succeed in space and missile operations. But so do those without technical degrees. In this renewed era of limited resources, it is time to focus recruiting where the Air Force needs it, and limiting where it does not. If an expensive degree is required for a particular job, so be it. The Air Force should recruit appropriately to get the right person with the set of necessary skills required for the job. Space and missile operations is a unique career field. No longer do blue-suit space operators troubleshoot their systems in the event of a major technical malfunction the Air Force pays contractors to do that. However the Air Force still needs intelligent warriors to lead, as well as manage these multi-billion dollar systems. Every person counts. Every dollar counts. Training and education counts. It is time that the Air Force realizes that it needs to make every dollar invested in training and educating in every person count.

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Abstract

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Space and missile operations is a career field that has a force where almost 30% possess technical degrees; in fact over 50% of 2009's Air Force Academy graduating class categorized as a 13S has a technical degree, yet this paper will show that no such degree is required. This is too much. The attitude of, "train everyone to the same high standard, and they can succeed in any job," is not without merit; engineers and those with technical degrees can and do succeed in space and missile operations. But so do those without technical degrees. In this renewed era of limited resources, it is time to focus recruiting where the Air Force needs it, and limiting where it does not. If an expensive degree is required for a particular job, so be it. The Air Force should recruit appropriately to get the right person with the set of necessary skills required for the job.

Space and missile operations is a unique career field. No longer do blue-suit space operators troubleshoot their systems in the event of a major technical malfunction – the Air Force pays contractors to do that. However the Air Force still needs intelligent warriors to lead, as well as manage these multi-billion dollar systems. Every person counts. Every dollar counts. Training and education counts. It is time that the Air Force realizes that it needs to make every dollar invested in training and educating in every person count.

Setting the Stage

Reason for Research: The Chief of Staff of the Air Force (CSAF) and the Secretary of the Air Force (SECAF) have directed the research of this topic. The CSAF/SECAF are specifically looking at the space "industrial base," and how America can best prepare itself to continue space dominance in times of fiscal constraint. Leading defense contractors continue to merge their efforts, and waves of senior space engineers retire. As the space industry re-shapes itself outside of the Air Force, it is similarly time for us to re-examine where today's blue-suit space and missile operator's recruiting dollars could be best-spent; this would maximize the Air Force's return on investment and synergize the effectiveness of the military and contracting community. The nation's space program continues to evolve; it is becoming more and more obvious that today's investments determine tomorrow's continued space control and dominance. The Air Force can best ensure the political leaders of the United States persistent supremacy of space by getting the right people into the right jobs at the right time. The Air Force space system is a complex hybrid of military, civilian, and contractor personnel, all working in concert to control the ICBM and satellite force. Maintaining America's position as the world's space hegemon will ensure that our nation retains the warfighting advantage of this "ultimate high ground."

Introduction: Today's space warriors have immediate access and impact to the nation's most critical assets: Satellites and Inter-Continental Ballistic Missiles (ICBMs). How can the United States Air Force best prepare the next generation of space combatants to meet the threats of tomorrow? As technology continues to increase at a blistering pace, it is obvious that the military needs smart people to operate these systems, but are they required to be smart in the managerial aspects, or must they be smart at the technical aspects as well? This paper argues that, in terms of making an officer more effective, there is no advantage to an officer having a

technical degree in the majority of the 13S career fields. From an investment perspective, scarce recruiting and education dollars need to be more focused on acquiring individuals with the necessary skill sets required from the jobs the officers will perform.

Like the rest of the Air Force, quality officers abound in the space community. It is the personal traits of today's space operators that guide and inspire them to skillfully perform their jobs - not necessarily whether or not they have an engineering or hard-science technical degree. This is not to say that a space operator with a technical degree would be less competent than a non-technical counterpart; it is merely to say that the technical degree does not make the space operator more effective in the traditional role of Satellite operator or ICBM crewmember.

Research Methodology. Of the six possible 13S career fields (Ground Based Missile Warning Surveillance (GBMWS), ICBM launch controller (missileer), satellite command and control, space lift, space based missile warning surveillance, and space control), the traditional "space operator" roles will be most closely examined (GBMWS and missileer). The research methodology for this paper will be interview-based case study as well as statistical analysis of current and trending space-operator personnel allocations. Due to the short time constraints and limited scope of this research project, six 13S space/missile officers from Air Command and Staff College (ACSC) were selected based on available breadth of 13S operational space experience in the GBMWS and missileer backgrounds. Two are current ACSC instructors and four are current ACSC students. Of the instructors, one has a technical degree, and one does not. Of the students, two have technical degrees and two do not. This mix best enabled a balanced perspective given the working limitations for this research. The interviews contained open end questions, and inferences were made as to how well prepared the officer was to perform their duties, as well as whether or not a technical degree did or would have made a difference. All

interviewees were asked the same set of 13 questions that focus on the space operators background in the GBMWS or missileer career field to include training, required analytical skills, managerial tasks, as well as perceptions of their relative preparedness for each of their 13S jobs. Their comments were recorded and analyzed for possible themes across the participants. Further analysis assessed whether or not a tech degree helped the officer succeed, or more importantly, a non-tech degree hurt the career or the ability to skillfully accomplish and master their job. Field grade officers were required for the research because they have the sufficient experience and background to assess the successes and shortcomings in their relative careers. The Air War College was intentionally left off this data set because of the time requirement for one-on-one interviews, as well as the desire to get officers relatively at the same points of their careers.

Research Scope: A notable limitation of this research paper is that of scope. The fact that only ACSC faculty and students were chosen for interview is a limitation in and of itself, however the caliber of the interview participants (Intermediate Developmental Education (IDE) in residence students – approximately the top 20% of a particular year group[1] – and those chosen to teach them), offers immediate credibility to their response. It should also be pointed out that the majority of the interviewees have been career space or missile operators serving in supervisory and leadership roles. They were also all instructors, and most were evaluators, in their weapon system. The majority of the respondents have also served in various capacities above the squadron level, further broadening their perspectives and solidifying their authority as subject matter experts. Further research should be conducted on a wider scale, possibly from the Major Command (MAJCOM) or higher level.

Definitions: For this paper, "technical degrees" are going to be bachelor degrees in engineering of all disciplines (electrical, aeronautical, mechanical, civil, etc.), as well as hard sciences such as math or physics. The term "non-technical degrees" refers to a bachelor's degree in business or other in a related field. The author will briefly discuss the history and trends of the post-secondary education system in the United States over the last 20 years, as well as a comparison of the national demand for those graduates with technical degrees versus non-technical degrees. Air Force technical degree costs will be discussed, in both the Air Force Reserve Officer Training Corps (AFROTC) scholarship as well as the Air Force Academy categories. Cost/benefit analysis of technical vs. non-technical degree will lead to conclusions and recommendations of the way to proceed in the future. First, a brief look at the last two decades provides insight into where the country has been in regards to these degrees, as well as a look as to where it is going. This analysis reveals alarming trends across the board, offering yet more reasons why accomplishing this research is important.

Problem Background and Significance

Technical Degree Trends: According to the National Center for Education Statistics, engineering degree numbers over the past 20 years in the United States have not grown at the same rate as their non-technical counterparts, specifically business. Business graduates have grown at 34% over the last 20 years to engineering's loss of 16%. Couple with the fact that there are almost four times as many management graduates as there are engineering graduates, and it becomes readily obvious which way the trend is leaning; the number of non-technical bachelor graduates is growing, and the number of job-seekers with technical degrees is shrinking.[2]

There are several possible causes for this; I will discuss the two most probable. First, schools are charging more for a degree in engineering than they do in other traditional liberal degrees.[3]

And second, the economy has continued to shift from a manufacturing based economy, to a service based economy.[4] The civilian sector tends to be more adaptive to paying what a person is worth by rapidly adjusting to the supply/demand of the workforce. The Air Force usually has low manning or poor retention in particular career fields for a few years, and then approaches Congress about authorizing bonuses or other retention aids.[5]

So all that being said, does it really matter? In the space world, does one do a better job because they are technically and technologically proficient, or do the best officers come from the institutions producing managerial degrees? Or is it actually a hybrid of the two as Brian Newman suggests in his article *Knowledge vs. Engineering*?[6] Given the trend, it will be more expensive for the Air Force to recruit and retain those with technical degrees due to competition in the civilian marketplace. Today's space force is highly augmented with government service civilian personnel, as well as many technically proficient contractors. With limited resources, the Air Force must ask the tough question: Does the investment of a technical degree in a space operator make fiscal sense if that degree is not used in the career field?

Historical Comparisons: Over 20% of today's Air Force officers are pilots – this is significantly larger than any other job occupation in the Air Force.[7] Back in World War II, the requirement for a pilot was simply someone who was able to fly. Pilots went through the aviation cadet program – and when it was determined that they could fly, they received their wings and commission. There was no requirement for a college degree. Probably the most famous test pilot to have the "right stuff," but not have a college degree, is Chuck Yeager. As long as someone was trained to fly, their prior education was irrelevant. Even for those with degrees, someone did not have to have a degree in aeronautics or weather in order to excel in the

flying world. One example of this is General Andrew Iosue – he had a very successful career – all of it with active flying, and all with a degree in bacteriology.[8]

Flying is arguably as difficult as space or missile operations, possibly even moreso when the physiological aspects are factored in. Yet flying operations were not birthed with the same high level mathematics and calculations required from space operations. As space operations matured, a lot of the heritage and legacy regarding education remained. Space was cutting edge, and all of the physics, orbital mechanics, and propulsion calculations had to be derived by hand. New materials had to be invented to withstand the rigors of space travel and the space environment. Complex computer technology would not catch up to the space industry for almost 40 years after man first traveled to space. All of the astronauts had science and engineering degrees as test pilots, and those who built the missions also had the same technical educations. This was precisely what kept Chuck Yeager from being one of the first Americans into space – not only his lack of a college degree, but it was his lack of a technical degree as well.[9] As time went by, space travel (NASA/Shuttle), commercial industry, and even the military started to view space operations as "routine." Rather than conduct space operations as strictly a uniformed military force, the Air Force migrated to the present day system of Air Force management and operations, with contractor execution and support. Even though a technical degree is not mandatory for a space or missile operator, it is still listed by the Air Force Personnel Center (AFPC) as "highly desired,"[10] a holdover requirement from an institution that prides itself on technology.[11] Yet as it stands today, almost 1 in 4 space operators have a technical degree![12] This is too much. While it is a slight decrease from four years ago, the downward trend should continue if the Air Force wants to efficiently recruit and retain qualified (but not *overqualified*)

individuals unless the Air Force is serious about the requirement and necessity for space operators to hold a technical degree.[13]

Governmental Activities: The Air Force, although still the most technical service in the military, does not necessarily need an officer cadre with the same technical skills as in the past. Since their inception, ICBM operator crews have always been checklist driven and removed from technical calculations and analyses; they were mostly concerned with the command and control up through launch, while civilian and military rocket scientist concerned themselves with ascent, re-entry, navigation, and targeting. This is in sharp contrast with the satellite operator throughout the 1950's and 1960's; the Air Force was sending satellites up into space at the rate of one every 2 months, and it was active duty Air Force members who were working with NASA to get the satellites into space.[14] Now the demographics have shifted quite a bit – no longer do active duty Airmen crunch the numbers to ensure mission success – that is left up to highly skilled and specialized contractors. The question whether or not time and energy are better placed in the hands of the supporting space industry, or in the hands of uniformed military has been often debated as of late.[15] One of the best things that contractors offer is the flexibility for use when needed, and more importantly, the utilization of contractors does not affect the congressionally-mandated troop "end-strength." The fundamental question to ask is whether the blue-suit space operator is serving in a military core competency; if so, what are the proper skill set and education requirements to make that officer effective? If not a core competency, would this be a job that a contractor could fill? The more cost efficient answer in many cases is to outsource to the contractor. The Cold War's end has led to the government in general seeking to outsource more activities that are not inherently "governmental."[16]

It is for precisely these reasons that we question whether or not the DoD's limited tax-revenue is best spent on recruiting and retaining the high caliber/high cost officers with technical degrees into the world of space operations, or if a non-technical degreed space and missile operator gets the job done just the same.

College Costs: The cost of college degrees is skyrocketing. According to *The College Board*, average tuition cost (in constant 2008 dollars) for public four year universities has doubled in the last 20 years, while private university tuition has nearly tripled.[17] This massive increase in cost has affected people's ability to go to college where they want, if they could go to college at all. The Air Force has been equally subject to these increases, as there are many scholarships offered annually by the Air Force Reserve Officers Training Corps (AFROTC). AFROTC offers many different scholarships to recruit qualified college-bound candidates into the Air Force. The most sought after scholarship is the Type 1 scholarship. This pays 100% of tuition, fees, and books for any university. As one can imagine – this cost can get upwards of $160K for a technical degree from a prestigious private university, such as Massachusetts Institute of Technology.[18] In this example, when paying for a technical degree, would it not make the most sense to use that person in a career-field *requiring* a technical degree?

Officer Accessions: It appears there may be a communications break between officer accessions and assignment personnel. When assignment personnel are looking to fill people into job availabilities, they always look to ensure that a person is *qualified* to fill a job. You would likely not find a philosopher going into a job as a civil engineer. The problem lies with the fact that there are inadequate processes in place that looks to see whether an officer is *overqualified*. Each individual Major Command (MAJCOM) in the Air Force dictates their educational requirements for Air Force Specialty Codes (AFSCs) under their purview.[19] MAJCOMs

squander millions of dollars annually by not accurately assessing which AFSCs *must have* a technical degree, instead of which are *nice to have.* This ends up placing overeducated and overqualified personnel in jobs where the technical degree is not required. A good example of placing technical-degree holders into the 13S field where they are not required is the Air Force Academy (USAFA).

Of the 2009 USAFA graduating class, 53% of those going into the 13S career field are those in technical fields! This is approximately double the rate of the active duty13S career field as a whole across all officer ranks.[20] This number is fairly consistent over the last few years as the stats for the 2005 class (earliest available) are approximately the same. When you consider that each USAFA produced 2nd Lieutenant has a $400K degree, this is no trivial amount of money.[21] Why then, if there is no requirement (only a desire) for a technical degree in the space and missile field, are there so many officers with technical degrees serving? The answer lies with the accessions process. As mentioned above, people are placed into job openings with only regards paid to their qualifications, not their possible *over*qualifications. The way it stands today (with more technical educated officers accessed than required), the technical educated "leftovers" would have to go somewhere until the officers put in to the pipeline meet (not exceed) the requirements on output. As stated previously, this problem would take several years to solve.

Previous Research On Topic: In 2005, Headquarters of Air Force Space Command conducted a study entitled, "Space Professional Education Needs Assessment." This study took a critical look at the 13S officer space force, and what specific training and education requirements would lead to mission success. The most notable finding was that they came back to the point they already intuitively knew – technical degrees were not required to be successful space and missile operators.[22] Air Force training programs, and Air Education and Training

Command as a whole, ensure that the right skill is given to the right person at the right time. Air Force Space Command is no different. The Space Command study differed from this one because they were attempting to find what was the necessary baseline of knowledge required for space officers. The senior leaders on the panel ascertained that there was a need for this baseline, and with it, they modified the three levels of Air Force-provided formal space education: Space 100, 200, and 300. Review of the Space 100 syllabus reveals that there is a level of technical training required of their officers, however it is designed for those without a technical degree.[23]

The 2005 study specifically addresses the question of technical degrees from the highest levels of space leadership; 13 General Officers and 18 Colonels had input to the report. Most of these senior leaders were group commanders or above, in the space field, at the time of the report. This report is the most recent and comprehensive top-down review of space officer education and training available. The report illustrated two key points: A baseline of knowledge is required for successful execution of the space mission, and no change to officer accessions is required. While the author agrees with the need for the knowledge baseline, there is a stark difference in the opinion of whether or not a re-vamping of officer accessions is required.

Cost Comparison Between Military Officers and Civilians

In 2004, a study was published under the direction of the Institute for Defense Analysis that investigated the cost of active-duty military officers performing science and technology duties in the 32E, 33S, 61S, 62E, and 63A career fields (civil engineer, communications-information systems, scientific/research, developmental engineering, and acquisition program manager respectively). While this research does not directly tie to the question of technical degrees for

space operators, the conclusions are worthy of note. The study found that technically proficient government-service civilians were, on average, approximately 20% cheaper than their military counterparts.[24] This study accounted for all pay and allowances, retirement contributions, health care, PCS costs, as well as the current critical skills retention bonus (CSRB) of approximately $10,000/year for officers working in a science and technology field. When the bonus is not included, the average cost of an officer is approximately 14% higher than that of a comparable civilian.

This study's analysis is important because it shows what the cost comparison is between officers and civilians *using their technical degrees where technical degrees are required.* There is no such requirement for space officers. It stands to reason that the technical degree only drives up the cost of the officer, as illustrated by the Air Force instituting a CSRB for those career fields with a technical degree. If the degree is required, the Air Force has no problem (nor should it) paying the required wage to recruit and retain the best possible person for the job. However if a qualified person is in the Air Force doing a job that does *not* require a technical degree (such as ~30% of space operators), there is no reason why that person should not be utilizing their degree in a field which requires it – especially if the Air Force paid for the education of the officer.

While it is easier to compare GS employees to military officers, it is more difficult to compare the cost of civilian contractors to military officers or GS civil-servants. The variables are many and include job location, program needs, specific degree requirements, Air Force contract overhead, as well as the individual company's pay-scales. According the Institute for Defense Analyses, the salary of recent technical graduates into the private sector are often higher than their military counterparts. However military pay rapidly catches up and soon exceeds the private sector when benefits are calculated in.[25] This in and of itself is only attributable to the

salary of the employee; often times the cost of the contractor will exceed that of the military employee due to mark-ups from contractors to address the overhead of the company (managerial costs and profit to name a few).

Next we shall closely examine the careers of six mid-level Air Force space and/or missile operators to see whether or not a technical degree did or would have made a difference.

Interview Results and Case Study Analysis

Interviewees will be referenced by number; biographies of each interviewee can be found in Appendix 1.

Of those officers with technical degrees, all had their degrees (tuition, fees, books) 100% paid for by the USAF. When asked if they would have pursued a different course of study had the Air Force not paid for their education, only one of three said they would have changed their majors if able; however since the Air Force was paying their way, they figured they would go where the money was. As for the non-technical officers, one of three was on scholarship, but of the lesser variety (ie, not 100%). Comparing the technical vs. non technical degree holders, those with a technical degree showed a difference of ~$95K average in cost difference to the USAF.

Four of the six officers had space operations as their first choice for an AFSC. Collectively, the officers have held a variety of different jobs at various levels and in different weapons systems – both in the ICBM world as well as the space world. While their experiences were obviously unique to them, the answers they gave led to some common themes across the board. The most notable is that of those officers who had technical degrees, not one of them said they ever needed to draw upon their education to be a competent and successful space or missile officer. As for the non-technical degrees, none of the officers ever felt like there was more technical knowledge required than they were able to keep up with. Further questioning revealed that, even though they all entered the space or missile field early in their careers, they could still "walk the walk, and talk the talk," soon after they arrived at their operational assignments. All of

the officers went through some form of initial indoctrination into the space career field prior to their technical training. Besides #1 and #2, this was in the form of Space 100.

All of the technical degree holders indicated that, while possessing a sharper technical skill set than many of their classmates, they still learned quite a bit in their initial space course. #1 and #3 hypothesized that their early success in their careers may have been because of the analytical skills learned in the course of undergraduate technical study. While this is not disputed in this research, it in and of itself does not necessarily make for a better space operator. As for the non-technicals, they agreed that the Air Force baseline education, mandatory for all new 13Ss, taught them "what they needed to know" in their indoctrination course, and it was good enough to set them up for success for their first operational assignment.

All of the responders indicated that their jobs were driven by checklists and technical data guidance. There was very little analytical thinking that went on, especially in the missileer career field. For the GBMWS operators, there was a small amount of analysis as to whether or not a missile detection was "valid" or not, however existing guidance directed to call the detection to higher headquarters if ever unsure since time was of the essence. For those with technical degrees, there was a unanimous consensus that the technical skills learned in undergraduate education gave them more of a "natural curiosity" into the inner-workings of the systems they were operating, however they still operated under specific technical order and checklist guidance making that curiosity irrelevant.

It is readily obvious that space based and ICBM weapons systems are extremely complex, however today's space operators and missileers do not shoulder the heavy burden of technical knowledge required to run such systems. They leave that to the contractors. Today's contractors

are the corporate knowledge behind the scenes of most Air Force weapon systems. Where Air Force officers move around from job to job every 2-4 years for required depth and breadth later on in their careers, contractors will often work the same job, in the same location, on the same system, for ten years or more. The "heavy lifting" of technical analysis, troubleshooting, reporting, or upgrade proposals most often comes from the contractors. All respondents indicated that they worked closely with the contractors in their various jobs, but the space operators were responsible for the operations and management of the systems, and the contractors for the technical workings of the system. In all cases, contractors were the Subject Matter Experts (SMEs) and system administrators. In his career, #2 indicated that it was often retired military maintenance personnel who transferred into contracting positions where they continued to work on the same system.

While in all cases there were many contractors, there were also a myriad of government service (GS) employees. While the contractors were still the system administrators, troubleshooters and site support personnel, the GS employees were generally the Quality Assurance (QA) piece. QA is inherently a governmental function that monitors and assesses the contractor's performance. While these QA personnel were not required to have the deep technical understanding of the contractors, they still needed a fairly broad technical knowledgebase to ensure that the contractors were doing what it was they were supposed to be doing. While the GS employees were often supervised by active-duty Air Force officers, the officers were not "in the weeds" needing to know the minute details of day to day testing and analysis of system health.

One thing that all of the officers agreed upon was their need for solid leadership and management skills. Officers, like in any good military organization, must lead people and

manage things. Space officers often supervised people in addition to their jobs as Missileers, satellite or GBMWS operators. Complex systems like ICBMs, Satellites, or GBMWSs require a lot of care and feeding to ensure they stay healthy and mission-ready. Scheduling the up/down time of a system requires skill across all spectrums of operations. Coordination between agencies, as well as up/down channel reporting ensures seamless operation and service delivery to the nation's Combatant Commanders. All of the space operators interviewed indicated that there was much effort expended to make certain that the high-demand, low-density national assets were available and ready as promised.

Of the officers with technical degrees, 2/3 of them indicated that their analytical skills did help them accomplish tasks that were not core to their primary jobs of space and missile operations. #1 said that he wrote a computer program to track the scheduling status of the missile systems, "because he could." While this is an obvious benefit of the technical degree in this example, computer programming is not required as a 13S core competency. If the Air Force requires computer programming of a specific task or job within the 13S core AFSC, then the job description should be written as such.

#4 indicated that as a Program Manager (PM) of a satellite based sensor development, he continuously used his technical degree. While this was a self-perceived anomaly among 13Ss, he said that the degree was essential to completing this task. When questioned whether or not he would have been able to carry out the duties of the job if he did not have a technical degree, his answer was a quick, "No way." Further discussion revealed that he was handpicked for this job because of his technical degree. This was the only case of a degree being used as a discriminator for a job, assignment, or career progression. A PM is typically an acquisitions AFSC (62xx or 63xx), and technical degrees are often mandated for these positions. This happened to be a rare

case of a 13S job opening requiring a technical degree for duties normally performed by a 62xx or 63xx.

Interaction with #4 and the contractors and civilians that worked for him is also interesting. The contractors still provided much of the heavy lifting of the technical forecasting, analysis, reports and troubleshooting, however #4 had to be integrally involved at every step of the way. As the senior government representative on the program to the contractors, it was imperative that he have a solid working knowledge of everything the contractors did. If he failed at his task, it is likely that unnoticed mistakes could have cost the government millions of dollars if they were not caught and corrected as #4 often did. In this case, the technical degree was required for this particular job. Once again, if a technical degree is required for successful accomplishment of the job, the job description should note it as such.

13S Technical vs. Non-Technical Career Analysis

Analysis of the officer's careers shows that there is no direct correlation between whether or not a technical degree helps lead to a more solid officer. The reason for this is varied, but most likely due to the fact that military contractors pick up the majority of the heavy lifting when it comes to the technical aspects of the job. Even though an officer may be trained to calculate how to get a satellite into orbit, or how long to burn to change orbits, the odds are that these skills will never be used while the officer is in uniform. Of course there will always be the need for some engineers that work directly for the government to supervise the contractors, however these don't necessarily need to be uniformed service members – these can be GS civilians. Obviously this scope is limited to 13S missileer and space operators; there would still be a valid

requirement for a handful of specialists on the control floors, as well as in the Systems Product Group (SPG) for contract evaluation and execution.

As far as career impact, 5/6 of the officers did not perceive that a technical degree was more essential to success in the 13S career field (the only discrepancy was #4's experience as a technical program manager discussed above). There were never any special treatments of an officer (ie, good Temporary Duty (TDY) assignments, promotions, assignments, jobs, etc.) based on what kind of degree the officer brought to the table. The officers interviewed view themselves as just that – officers. They, across the board, never felt as though their degree defined who they were or what they were capable of while working as a space or missile operator. Having a degree, technical or other, was simply the price of admission to get the privilege of serving as an Air Force officer. #6 talked about attitude being the primary discriminator in successful and unsuccessful space and missile officers. He said, "Any person can be taught to run a checklist – Read a step, do a step, eat a banana. However if you have someone with a bad attitude at a standard missile base [Minot, Grand Forks, Malmstrom] in the Northern tier, their performance is going to suffer, and the unit as a whole is going to pay the price." All interviewees agreed that it was the personal traits of an officer that defined who the person was, and ultimately determined the level of their success in their career.

Leadership abounds in the space and missile operations force. All of the officers interviewed held some form of supervisory position at some point during their careers. While the leadership and supervisory roles are required for the overall development of officers, it takes away some of the time required to stay proficient in the technical aspects of a job. The further up an officer moves in his or her career, the further away he or she gets from the "nuts and bolts" of a system. And that is precisely what they should be doing. Leaving the analysis and troubleshooting of a

system to the professionals (SME contractors) is the most efficient use of the resources available in the current system.

Conclusions

The way that the Air Force trains its space officer corps is correct; a college educated officer walks in the door, and a trained space professional walks out. The relatively new courses that space professionals take (Space 100/200/300) are designed to give the baseline of knowledge required for successful mission accomplishment. For space and missile operations – this knowledge baseline is sufficient. Any officer can be a space officer with successful completion of the space professional course consistent with their career development level. No technical degree is required, however the baseline taught during the courses will make the professionals successful "knowledge managers."[26]

Keeping the edge in space while suggesting to lower the technical requirements of space operators is a challenge. Contractors must continue to play an important role in the mission of the space force. The active-duty officers controlling the day-to-day operations of satellites and missiles do not need the technical insight into the guts of the systems; by and large, the fundamentally governmental responsibilities of these 13S positions do not need the technical degrees for mission accomplishment. For those jobs that do, it is time to civilianize the position, contract it out, or tag the AFSC as one requiring a specific degree.

Should these conclusions be implemented into 13S space operator accessions, it is imperative that contracting and acquisition officers be made aware of the changes. There can be no contracts awarded based on the assumption that there are specialized 13S officers with technical degrees serving in the field. When highly technical contracts are source-selected for award,

consideration must be given to not only the cost of the proposed bid, but the quality of technical expertise that the contractor can provide. Most 62 and 63 AFSCs are acquisition specialties requiring a technical degree. While this is a solid requirement for getting the system to the field, the Air Force needs to continue the support once fielded. 13S operators are not the best people for that support, however technical experts are still required. All programs have a level of governmentally sponsored technical support (military or GS) at the unit and the SPG level. This must not suffer in the face of the sweeping requirements proposed. If technical degrees for space and missile officers are going to go by the wayside as projected, extra attention must be paid to the government employees or contractor with the required technical expertise to ensure uninterrupted mission accomplishment. It boils down to a personnel decision; if technical savvy does not come from the 13S space operator, then there must be suitable contractor and/or GS support to maintain the requisite level of technical system proficiency.

Prior planning helps ensure successful execution. Right now, the Air Force is spending millions of dollars each year to ensure that it recruits America's best and brightest into its officer corps. The problem of spending money to recruit is not at question – what is at question is where that money is targeted. Give AFROTC scholarships to develop officers with required skills for when they get in the Air Force. The way the Air Force operates today is to spend exorbitant amounts of resources to recruit engineers and those with technical degrees, and then never place the officers in jobs where those skills are needed. Technical degrees are highly perishable; if an officer does not use the degree early in the career, that knowledge will be gone, and the officer will need re-training to get them back up to speed. In this time of simultaneous wars, economic downturn, and increasing fiscal restraints, the Air Force owes it to the public that it serves, to ensure unwavering mission accomplishment for the lowest possible cost. By over-educating the

space and missile operator corps, the Air Force is not getting better operations of space and missiles – they are merely getting the same mission accomplished, only at a much higher price.

Suggestions for Additional Research

There is still plenty to be done on this topic. The problem lays mostly with the long-term needs assessments from the Air Force Space Command. As of today, many of the Air Force's new Lieutenants are educated as engineers because they can fill a variety of jobs. While this is true, it is also very expensive. By accurately forecasting the needs of the Air Force, and the space force in particular, this problem can be solved in the next 5-10 years. Further analysis is required of the interaction between officer accessions (USAFA, AFROTC), personnel placement, the A1 (Air Staff Personnel), and the functional manager of space professionals. This would reveal where officer requirements forecasting needs scrutiny.

Should another study of this nature ever be conducted, it would be necessary to increase the scope and breadth of interviewed personnel. This study only focused on mid-level majors. A mid-level captain space operator could probably reveal much about technical preparedness, just as Lt Colonel or Colonel could offer a varying perspective. The larger population size with statistically significant numbers could well reveal a whole host of other issues not addressed in this paper.

Further career field definition within Air Force Specialty Codes (AFSCs) could also take some of the guesswork out of figuring which individuals are best qualified to accomplish a job. As it stands right now, a 13S can accomplish any of the six career fields listed earlier. If the AFSCs were broken down by job, and therefore by requirement, officers could be directly recruited into those positions with the degree and skills necessary for success. There are a few

13S positions that require a technical degree, but the majority do not. As a corollary, there are certain staff jobs that require a "W" prefix for those with USAF Weapons School training – maybe it is now time to have a "T" prefix (for "Technical") on those career fields in the 13S AFSC? With the aim of recruiting qualified – but not overly qualified – individuals into the career field, this is an idea whose time has come.

Once non-technical college educated officers enter the space world, it is more important than ever to ensure that they get the requisite baseline knowledge and training to successfully master their jobs. As less and less technically educated individuals enter the space and missile operations career field, as this paper argues, more of the burden falls on the Air Force to give them the training they otherwise would have may have received in college. Ensuring that the Space 100/200/300 syllabi cover all of the skill sets required of the officers before they show up at operational units is of utmost importance. When the suggestions presented in this paper are implemented, a top down review of personnel skill requirements, as well as the syllabi of the courses that teach the skills, will both need to be accomplished. The leaders at the highest levels of Air Force Space Command have been very proactive in identifying necessities in terms of training and education for their officers. The 2005 study highlights the needs of the knowledge baseline; now they need to implement these suggestions, and execute the training so tomorrow's officers are ready to meet the warfighter's space-based challenges of the next decade.

Contractor personnel and the systems program group would be more important than ever. A review of all current contracts for technical suitability would be necessary to ensure that no technical requirement fell through the cracks. Highly experienced operations personnel are always critical at this phase, as it is their input that drives the requirements around which these

contracts are built. Under no circumstances should requirements or mission execution suffer due to a lack of technical expertise in the operator corps.

Contractors and civilians are often as dedicated to the warfighting effort as their military counterparts. Everyone has his or her own niche and contributions to the mission. It is time that the Air Force clearly defines whose role is what in technical program acquisition, management, operations, and sustainment. As our current acquisition policy guides, contractors should continue to do the bulk of the technical analysis and design while highly skilled and specialized government employees (military or GS) monitor and oversee. However it is not cost effective for the Air Force to expect that space and missile operators can attain or sustain any deep level of technical knowledge with regards to their systems. With that in mind, there is no reason that the Air Force should continue paying top dollar to recruit these highly skilled engineers, and then place them into a non-technical career field. Engineers will always be required in the modern Air Force that prides itself on technology, however space and missile operations is not one of those places.

APPENDIX 1

Case Subjects

The case-subjects are referenced by number, with the following numbers in use throughout the study.

1. Lt Col John Hagen is on faculty at ACSC holding a technical degree. For his undergraduate education, he earned a Bachelor's degree in Aeronautical Engineering from Boston University. Subsequently, he has earned three Master's degrees (all non-technical), and a Ph.D. from the prestigious Fletcher University (also non-technical). He had one assignment as a Missileer at Grand-Forks AFB. During that time, he held a variety of jobs, to include Missile Crew Deputy Commander, Missile Crew Commander, as well as a Flight Commander, supervising ten other missile crews.[27]
2. Lt Col Richard Rogers is on faculty at ACSC holding a non-technical degree. For his undergraduate education, Lt Col Rogers earned a Bachelor's degree in Business Administration. While on active duty, Lt Col Rogers subsequently received a non-technical Master's degree in General Administration from Valdosta State University. He is a career space and missile operator, serving in both the ICBM and GBMWS career fields. He was a qualified instructor and evaluator in both Major Weapons Systems, to include as the Chief of the Missile Warning Branch, 14th Air Force Headquarters at Vandenberg Air Force Base. Throughout the course of career, Lt Col Rogers has held jobs at the squadron, wing, and Numbered Air Force levels.[28]
3. Maj Sarah Dahl is student at ACSC holding a technical degree. For her undergraduate education, Maj Dahl earned a Bachelor's degree in Mathematics from the University of Alabama, Birmingham. She subsequently received a Master's degree in Operational

space systems management. She started career as an acquisition officer, and then transferred into the 13S career field as a satellite operator. During her tour as a satellite operator, Maj Dahl held several supervisory and leadership positions, including instructor and flight commander.[29]

4. Maj Sean Boles is a student at ACSC holding a technical degree. For his undergraduate education, he earned double Bachelor's degrees in aerospace and mechanical engineering from the US Naval Academy. He is a career space and missile operator. He has held various assignments throughout his career at the squadron, wing and Numbered Air Force level, to include a job as a program manager of a weather satellite with over 100 civilian, contractor, and military personnel reporting to him. He has been an instructor and senior evaluator in all of his weapons systems.[30]
5. Maj Nikki Kissiar is a student at ACSC holding a non-technical degree. For her undergraduate education, she earned a Bachelor's degree in psychology from Southern Illinois University, Carbondale. She subsequently earned a Master's degree in Educational Leadership from Touro University. Maj Kissiar is a career space and missile operator, serving as an instructor and evaluator in each of her major weapons systems. She has held several supervisory positions throughout her career, most notably as the Functional Manager for all 13S officers, and most recently on the Commander's Action Group of the Air Force Space Command.[31]
6. Maj Justin Mulkey is a student at ACSC holding a non-technical degree. For his undergraduate education, he earned a Bachelor's degree in Economics from the Air Force Academy, and an MBA in Business Management from Touro University. Major Mulkey is a career space and missile operator. Major Mulkey has held several supervisory

positions during his career qualified as an instructor and evaluator in both ICBMs and GBMWS. He has been on the Commander's Action Group at 20th Air Force, as well as a Director of Operations and Commander at the Detachment level.[32]

NOTES

[1] Personnel Center, New Air Force Majors Selected for IDE.
[2] Department of Education.
[3] Glater.
[4] Department of State.
[5] Taylor, Moore, and Roll.
[6] Newman.
[7] Personnel Center, Air Force Personnel Demographics.
[8] Personnel Center, Iosue Biography.
[9] Yeager.
[10] Saldivar.
[11] Builder, 32.
[12] Personnel Center, 2008 13S Academic Demographics.
[13] Personnel Center, 2004 13S Academic Demographics.
[14] NASA.
[15] Boland.
[16] Associated Press, Iraq Contracts.
[17] Baum.
[18] Lucas.
[19] Lucas.
[20] Personnel Center, 2008 13S Academic Demographics.
[21] Hubal.
[22] Boland.
[23] Space Professional Management Office, Space 100, 4.
[24] Gotz, 48.
[25] Gotz, 36.
[26] Newman.
[27] Hagen Interview.
[28] Rogers Interveiw.
[29] Dahl Interview.
[30] Boles Interview.
[31] Kissiar Interview.
[32] Mulkey Interview.

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